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Chapter 7 System of Equations

Section 7.1: Developing Systems of Linear Equations

In this section, we will learn how to come up with equations that describe situations. You will have to use the facts from the problem and translate it into the language of algebra. For each unknown in the problem, a different variable must be given. Here's a simple example.

Example 1: *For the school play "Museum", adult tickets cost $15 and student tickets cost $10. On the Friday evening performance, there were 425 tickets that were sold.*

To determine how many of each type of ticket was sold, we can write two equations to model this situation.

a) identify the unknown quantities (give appropriate variables)

We have 2 Type of Tickets
- let (x) be the # of Adult tickets
- let (y) be ~ ~ ~ student tickets

b) translate the total number of tickets sold into an algebraic equation

# of tickets so $x + y = 425$ → ①

c) if the show collected $5125, translate the total value of tickets into an algebraic equation

∴ $15x + 10y = 5125$ → ②

the cost

The two linear equations $x + y = 425$ and $15x + 10y = 5125$ model the situation. These two equations form a system of linear equation in two variables. A system of linear equations is often referred to as a linear system.

x) (y)

d) Suppose you were told by the usher that 175 adults and 250 students went to the Friday evening performance. How could you verify that he was telling you the truth?

Check the total number of Tickets sold = 425
∴ $175 + 250 = 425$ this agree with the given data

Let's give you some practice in using two variables to represent situations algebraically first.

Example 2: For the following statements, identify the two variables and then create an algebraic equation.

a) two numbers have a sum of 75

* let the two numbers be (x) & (y)

∴ $x + y = 75$

b) two numbers such that seven more than the first number is double the second number

let (x) be the First number
let (y) be the second number ∴ $7 + x = 2y$

c) four pencils and three pens cost $2.50

let (x) be the cost of 1 pencil
let (y) be the cost of 1 Pen ∴ $4x + 3y = 2.50$

d) a number of nickels and dimes has a total value of $2

let (n) be the # of nickels ⇒ $0.05
let (d) be the # of dimes ⇒ $0.10 ∴ $0.05n + 0.10d = 2$

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Example 3: Create a linear system to model the following situations. Remember to identify your variables first.

a) the sum of two numbers is 176 and their difference is 48

- let x be the First number
- let y be the second number

$\therefore\ x + y = 176$

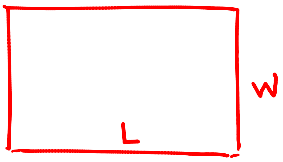
$\therefore\ x - y = 148$

b) The perimeter of a rectangle is 64 cm. Twice the width is 4 cm more than three times the length.

* let (W) be the width
* let (L) be the length

$\therefore\ 2W + 2L = 64 \rightarrow ①$

$\therefore\ 2W + 4 = 3L \rightarrow ②$



c) Mr. Marzouk rented a car for 3 days and drove 160 km and was charged $124 during Christmas break. He also rented the same car for 5 days and drove 400 km during Spring Break and was charged $219.

- let (x) be the charge per (day)
- let (y) be the charge per (km)

$\therefore\ 3x + 160y = 124 \rightarrow ①$

$\therefore\ 5x + 400y = 219 \rightarrow ②$

Example 4: Create a linear system to model the following situations by using a table.

a) The Andersons traveled 880 km from St. John's to Halifax. Part of their trip was by car traveling at an average speed of 80 km/hr, and the rest by ferry at 16 km/hr. The total traveling time for the entire trip was 27 hours. let (C) the car's time let (F) the Ferry's time

	Speed	Time	Distance $d = S \times t$
Car	80 km/hr	C	80 C
Ferry	16 km/hr	F	16 F

Equations:

$C + F = 27 \rightarrow ①$

$80C + 16F = 880 \rightarrow ②$

b) In Burnaby, a school raised $195 by collecting 3000 items for recycling. The school received 5 for each pop can and 20 for each large plastic bottle. The school collected 2700 pop cans and 300 plastic bottles. Use the linear system to verify these numbers.

	Refund per Item ($)	**Number of Items**	**Money Raised ($)**
Can	0.05	C	0.05C
Bottle	0.20	b	0.20 b

3000 195

Equations:

$C + b = 3000 \rightarrow ①$

$0.05C + 0.20b = 195 \rightarrow ②$

Assignment: 7.1: Page 401: 5, 6, 7, 8, 9, 10, 13, 15; Challenge 16, 18